1. A tissue engineering construct, comprising:
embryonic stem cells;
a three-dimensional cell support matrix, wherein the matrix is resistant to contractile forces exerted by the stem cells; and
at least one growth factor selected to promote differentiation of the stem cells along a predetermined cell lineage or into a specific cell type.

2. The tissue engineering construct of claim 1, wherein the stem cells are mammalian embryonic stem cells.

3. The tissue engineering construct of claim 2, wherein the cells are human embryonic stem cells.

4. The tissue engineering construct of claim 1, wherein the cell support matrix comprises a poly(lactic acid) – poly(lactic acid-co-glycolic acid) mixture.

5. The tissue engineering construct of claim 4, wherein the cell support matrix comprises a 50/50 mixture of poly(L-lactic acid) and poly(lactic acid-co-glycolic acid).

6. The tissue engineering construct of claim 1, wherein a cross-sectional area of the matrix is not reduced by more than 50% under a contractile force exerted by the embryonic stem cells.

7. The tissue engineering construct of claim 6, wherein a cross-sectional area of the matrix is not reduced by more than 40% under a contractile force exerted by the embryonic stem cells.

8. The tissue engineering construct of claim 7, wherein a cross-sectional area of the matrix is not reduced by more than 30% under a contractile force exerted by the embryonic stem cells.

9. The tissue engineering construct of claim 8, wherein a cross-sectional area of the matrix is not reduced by more than 20% under a contractile force exerted by the embryonic stem cells.

10. The tissue engineering construct of claim 9, wherein a cross-sectional area of the matrix is not reduced by more than 10% under a contractile force exerted by the embryonic stem cells.

11. The tissue engineering construct of claim 10, wherein a cross-sectional area of the matrix is not reduced by more than 1% under a contractile force exerted by the embryonic stem cells.

12. The tissue engineering construct of claim 1, wherein the cell support matrix further comprises a coating including an agent that promotes cell adhesion.

13. The tissue engineering construct of claim 12, wherein the agent that promotes cell adhesion is selected from fibronectin, integrins, and oligonucleotides that promote cell adhesion.

14. The tissue engineering construct of claim 1, wherein the cell support matrix is biodegradable or non-biodegradable.

15. The tissue engineering construct of claim 14, wherein the cell support matrix is selected from PLA, PGA, PLGA, poly(anhydrides), poly(hydroxy acids), poly(ortho esters), poly(propylfumerates), poly(caprolactones), polyamides, polyamino acids, polyacetals, biodegradable polycyanoacrylates, biodegradable polyurethanes, polysaccharides, polypyrrole, polyanilines, polythiophene, polystyrene, polyesters, non-biodegradable polyurethanes, polyureas, poly(ethylene vinyl acetate), polypropylene, polymethacrylate, polyethylene, polycarbonates, poly(ethylene oxide), co-polymers of any of the above, adducts of any of the above, and mixtures of any of the above polymers, co-polymers, and adducts with one another.

16. The tissue engineering construct of claim 1, further comprising one or more biomolecules, small molecules, or bioactive agents disposed within the cell support matrix.

17. The tissue engineering construct of claim 1, further comprising a gel that coats internal and external surfaces of the cell support matrix.

18. The tissue engineering construct of claim 17, wherein the gel is selected from collagen gel, alginate, agar, and Growth Factor Reduced MATRIGEL™.

19. The tissue engineering construct of claim 18, wherein the gel further comprises one or more of laminin, fibrin, fibronectin, proteoglycans, glycoproteins, glycosaminoglycans, chemotactic agents, or growth factors.

20. The tissue engineering construct of claim 1, wherein the growth factor is selected from cytokines, eicosanoids, and differentiation factors.

21. The tissue engineering construct of claim 20, wherein the growth factor is selected from activin-A (ACT), retinoic acid (RA), epidermal growth factor, bone morphogenetic protein, TGF-β, hepatocyte growth factor, platelet-derived growth factor, TGF-α, IGF-I and II, hematopoietic growth factors, heparin binding growth factor, peptide growth factors, erythropoietin, interleukins, tumor necrosis factors, interferons, colony stimulating factors, fibroblast growth factors, nerve growth factor (NGF) and muscle morphogenic factor (MMF).

22. The tissue engineering construct of claim 1, wherein the cell support matrix has a shape selected from particles, tube, sponge, sphere, strand, coiled strand, capillary network, film, fiber, mesh, and sheet.

23. A method of producing a tissue engineering construct, comprising:
providing a population of embryonic stem cells;
seeding the embryonic stem cells on a cell support matrix; and

exposing the embryonic stem cells to at least one agent selected to promote differentiation of the stem cells along a predetermined cell lineage or into a specific cell type,

wherein the step of exposing may be performed before or after the step of seeding, or both.

24. The method of claim 23, wherein the embryonic stem cells are mammalian embryonic stem cells.

25. The method of claim 24, wherein the embryonic stem cells are human embryonic stem cells.

26. The method of claim 23, wherein the cell support matrix is three dimensional.

27. The method of claim 23, wherein a cross-sectional area of the matrix is not reduced by more than 50% under a contractile force exerted by the embryonic stem cells.

28. The method of claim 27, wherein a cross-sectional area of the matrix is not reduced by more than 40% under a contractile force exerted by the embryonic stem cells.

29. The method of claim 28, wherein a cross-sectional area of the matrix is not reduced by more than 30% under a contractile force exerted by the embryonic stem cells.

30. The method of claim 29, wherein a cross-sectional area of the matrix is not reduced by more than 20% under a contractile force exerted by the embryonic stem cells.

31. The method of claim 30, wherein a cross-sectional area of the matrix is not reduced by more than 10% under a contractile force exerted by the embryonic stem cells.

32. The method of claim 31, wherein a cross-sectional area of the matrix is not reduced by more than 1% under a contractile force exerted by the embryonic stem cells.

33. The method of claim 23, wherein the cell support matrix comprises a poly(lactic acid) - poly(lactic acid-co-glycolic acid) mixture.

34. The method of claim 33, wherein the cell support matrix comprises a 50/50 mixture of poly(L-lactic acid) and poly(lactic acid-co-glycolic acid).

35. The method of claim 23, further comprising coating the cell support matrix with an agent that promotes cell adhesion.

36. The method of claim 35, wherein the agent that promotes cell adhesion is selected from fibronectin, integrins, and oligonucleotides that promote cell adhesion.

37. The method of claim 23, wherein the cell support matrix is biodegradable or non-biodegradable.

38. The method of claim 23, wherein the cell support matrix is selected from PLA, PGA, PLGA poly(anhydrides), poly(hydroxy acids), poly(ortho esters), poly(propylfumerates), poly(caprolactones), polyamides, polyamino acids, polyacetals, biodegradable polycyanoacrylates, biodegradable polyurethanes, polysaccharides, polypyrrole, polyanilines, polythiophene, polystyrene, polyesters, non-biodegradable polyurethanes, polyureas, poly(ethylene vinyl acetate), polypropylene, polymethacrylate, polyethylene, polycarbonates, poly(ethylene oxide), co-polymers of any of the above, adducts of any of the above, and mixtures of any of the above polymers, co-polymers, and adducts with one another.

39. The method of claim 23, further comprising adding one or more biomolecules, small molecules, and bioactive agents to the cell support matrix.

40. The method of claim 23, further comprising disposing the embryonic stem cells within a gel, wherein seeding the embryonic stem cells on the cell support matrix includes disposing the gel on internal and external surfaces of the cell support matrix.

41. The method of claim 40, wherein the gel is selected from collagen gel, alginate, agar, and Growth Factor Reduced MATRIGEL™.

42. The method of claim 41, wherein the gel further comprises one or more of laminin, fibrin, fibronectin, proteoglycans, glycoproteins, glycosaminoglycans, chemotactic agents, and growth factors.

43. The method of claim 23, wherein culturing is conducted in a serum-free medium.

44. The method of claim 23, wherein the agent is selected from a growth factor, a mechanical force, an electric voltage, a bioactive agent, a biomolecule, and a small molecule.

45. The method of claim 44, wherein the growth factor is selected from cytokines, eicosanoids, and differentiation factors.

46. The method of claim 45, wherein the growth factor is selected from activin-A (ACT), retinoic acid (RA), epidermal growth factor, bone morphogenetic protein, TGF-β, hepatocyte growth factor, platelet-derived growth factor, TGF-α, IGF-I and II, hematopoietic growth factors, heparin binding growth factor, peptide growth factors, erythropoietin, interleukins, tumor necrosis factors, interferons, colony stimulating factors, fibroblast growth factors, nerve growth factor (NGF) and muscle morphogenic factor (MMF).

47. The method of claim 44, wherein the mechanical force is selected from hoop stress, shear stress, hydrostatic stress, compressive stress, tensile stress, and combinations of the above.

48. The method of claim 23, wherein the cell support matrix has a shape selected from particles, tube, sponge, sphere, strand, coiled strand, capillary network, film, fiber, mesh, and sheet.

49. The method of claim 23, wherein providing includes culturing embryonic stem cells in the presence of a growth factor.

50. The method of claim 49, wherein culturing is conducted in a serum-free medium.

51. A tissue engineering construct, comprising:
embryonic stem cells;
a three-dimensional cell support matrix comprising a 50/50 mixture of poly (L-lactic acid) and poly (lactic-co-glycolic acid); and
TGF-β.

52. A tissue engineering construct, comprising:
embryonic stem cells;
a three-dimensional cell support matrix comprising a 50/50 mixture of poly (L-lactic acid) and poly (lactic-co-glycolic acid); and
a member of activin A, IGF, and any combination of the above.

53. A tissue engineering construct, comprising:
embryonic stem cells;
a three-dimensional cell support matrix comprising a 50/50 mixture of poly (L-lactic acid) and poly (lactic-co-glycolic acid); and
retinoic acid.

54. The tissue engineering construct of claim 51, 52, or 53, wherein the cell support matrix further comprises one or more of fibronectin or growth factor-reduced MATRIGEL.

55. A method of promoting tissue development, comprising:
providing a population of embryonic stem cells;

seeding the embryonic stem cells on a cell support matrix comprising a 50/50 mixture of poly(L-lactic acid) and poly(lactic-co-glycolic acid); and

exposing the embryonic stem cells to TGF-β,

wherein the cells produce cartilaginous tissue.

56. A method of promoting tissue development, comprising;

providing a population of embryonic stem cells;

seeding the embryonic stem cells on a cell support matrix comprising a 50/50 mixture of poly(L-lactic acid) and poly(lactic-co-glycolic-acid); and

exposing the embryonic stem cells to one or more of activin A and IGF,

wherein the cells produce alpha feto protein and albumin.

57. A method of promoting tissue development, comprising:

providing a population of embryonic stem cells;

seeding the embryonic stem cells on a cell support matrix comprising a 50/50 mixture of poly (L-lactic acid) and poly (lactic-co-glycolic acid); and

exposing the embryonic stem cells to retinoic acid,

wherein the cells develop neuronal tissue structures.

58. The method of claims 55, 56, or 57 wherein the cell support matrix further comprises one or more of fibronectin or Growth Factor-Reduced MATRIGEL™.

59. The method of claims 55, 56, or 57, wherein exposing comprises culturing the seeded cell support matrix *in vitro* for two weeks and the method further comprises implanting the seeded cell support matrix in an animal.

60. A method of promoting tissue development, comprising:

providing a population of embryonic stem cells;

seeding the embryonic stem cells on a cell support matrix;

culturing the seeded cell support matrix in the presence of a growth factor for a predetermined amount of time; and

implanting the cultured cell support matrix in an animal.

61. The method of claim 60, wherein the cell support matrix is selected from PLA, PGA, PLGA poly(anhydrides), poly(hydroxy acids), poly(ortho esters), poly(propylfumerates), poly(caprolactones), polyamides, polyamino acids, polyacetals, biodegradable polycyanoacrylates, biodegradable polyurethanes, polysaccharides, polypyrrole, polyanilines, polythiophene, polystyrene, polyesters, non-biodegradable polyurethanes, polyureas, poly(ethylene vinyl acetate), polypropylene, polymethacrylate, polyethylene, polycarbonates, poly(ethylene oxide), co-polymers of any of the above, adducts of any of the above, and mixtures of any of the above polymers, co-polymers, and adducts with one another.

62. The method of claim 60, wherein the three-dimensional cell support matrix comprises a 50/50 mixture of poly (L-lactic acid) and poly (lactic-co-glycolic acid).

63. The method of claim 60, further comprising coating the cell support matrix with an agent that promotes cell adhesion.

64. The method of claim 63, wherein the agent that promotes cell adhesion is selected from fibronectin, integrins, and oligonucleotides that promote cell adhesion.

65. The method of claim 60, further comprising disposing the embryonic stem cells within a gel, wherein seeding the embryonic stem cells on the cell support matrix includes disposing the gel on internal and external surfaces of the cell support matrix.

66. The method of claim 65, wherein the gel is selected from collagen gel, alginate, agar, and Growth Factor Reduced MATRIGEL™.

67. The method of claim 65, wherein the gel further comprises one or more of laminin, fibrin, fibronectin, proteoglycans, glycoproteins, glycosaminoglycans, chemotactic agents, and growth factors.

68. The method of claim 60, wherein the growth factor is selected from activin-A (ACT), retinoic acid (RA), epidermal growth factor, bone morphogenetic protein, TGF-β, hepatocyte growth factor, platelet-derived growth factor, TGF-α, IGF-I and II, hematopoietic growth factors, heparin binding growth factor, peptide growth factors, erythropoietin, interleukins, tumor necrosis factors, interferons, colony stimulating factors, fibroblast growth factors, nerve growth factor (NGF) and muscle morphogenic factor (MMF).

69. The method of claim 60, wherein the predetermined period of time is two weeks.

70. The method of claim 60, wherein culturing is conducted in a serum-free medium.